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ON ILLINOIS GROUSE LOCUSTS.

BY J. L. HANCOCK.

The theory of descent implies that modification of form is gradual, and that intermediate series have existed between any two forms that might be chosen. But when *existing* forms are brought together in which connecting links have perished groups can be practically separated for convenience. When two forms are in dispute specifically the definite way of determining whether they are distinct or not is to observe if they interbreed. This means, oftentimes, a long delay in confirming the validity of species after new discoveries are made. We can, in the absence of such proof, resort to the systematic study and comparison of characters. The breaking in on the attending series of evolutionary changes in nature allows, by induction, a distinction to be made of species by the exclusion of inconstant variations of structure. A large series of specimens of a common species of grouse locust will illustrate, viz.: 1. A generation of individuals closely resembling each other, but with structural peculiarities manifest as slight departures in each specimen from the parent (individual variation); 2. A group composed of examples in which slight, but similar lines of departure of structure occur (varieties); 3. Another in which analysis confirms progressive fixation of structure (insipient or sub-species); 4. Lastly, stronger though variable structural peculiarities recognizable as common characters (species). Besides, there are atavic dimorphic forms which are subordinate to species. The advent of modern discussions in evolutionary doctrines has made it particularly important to note the differences or plasticity in the organism. The contention that constant structural peculiarities be used in separating species leaves out those forms falling under the classes one to four. There has been a notable indifference to the grouping and characterization of species now in the actual process of evolving as in those outlined above. In the interest of advancing scientific knowledge their consideration is of much interest. Where mention is made of "species" is this group, the Tettigidæ, we are a good way along in permanency of characters. The great degree of variation occurring in the grouse locusts is well known. In so short

a paper we must leave the subject of the stages leading up to their origin to be considered at another time. Some earlier naturalists separated species on the ephemeral "color characters." As remarked by Uhler and more recently reaffirmed by others, they are practically of no classificatory significance. It is on the whole but proper to speak provisionally where variations are such a constituent part of the organism that we no sooner are desirous of immortalizing our *type* than forces of evolution mold or modify the characters by changing the lines of configuration in the monument raised in its behalf. Such is a picture of the Tettigidæ. Members are to be received tentatively until a careful revision is formulated after the descriptive stage has been completed in our North America forms.

With reference to the general classification of the grouse locusts, the excellent special essay by Bolivar,* aside from containing some confusing statements on North American forms already noted by Morse, is the most comprehensive work published. The absence of pulvilli between the claws, the shape of the pronotum, which extends backwards like a roof over the wings, often extending beyond the end of the abdomen and the small loboform wing covers (elytra) distinctly defines the group.

To Brunner De Wattenwyll entomological science is indebted for elevating the knowledge of the general relations of the Orthoptera to a much higher plane. In his "Revision,"† page 102, this group is placed as the first of nine tribes constituting the orthopterous division Acridiodæ. The current bibliography in America is replete with interesting papers. Especially noteworthy are articles by A. P. Morse, which, besides giving biological notes of merit, also note descriptions of new North American species. The writings of this author include a synopsis of the Tettigidæ in "Notes on the Acrididæ of New England" "Psyche," October, 1894, and a serial paper (two articles) on "New North American Tettiginæ" in March and September numbers of the journal New York Entomological Society. Jerome McNeill has contributed some valuable notes in "Indiana Orthoptera," "Psyche," 1894. W. S. Blatchley has enriched the literature in a serial paper under the title of "Indiana Acrididæ" in "Canadian Entomologist."

* Essai sur les Acridiens de la tribu des Tettigidæ (Ann. de la Soc. Entom. de Belgique, xxxi. 1887).

† Revision du système des Orthoperes. Genova, 1893.

The subjoined observations on Illinois grouse locusts are accompanied by original plates. Some evolutionary stages in the markings of *Tettix* are shown, and in this genus a feature is the introduction of enlarged sketches of the cephalo-dorsal outline. Over seven hundred specimens in the writer's collection formed the basis of this paper without mentioning the great store of specimens examined in the field alive, numbering into thousands. That portion of northern Illinois known as the Des Plaines, and a part of the Calumet River region in Cook County, formed the central focus of observations. So far recorded this group of locusts as found here is given in the accompanying list; a number are new. Among specimens from M. J. Elrod and Mr. Adams, of Bloomington, Ill., to whom the writer expresses obligations, there was one new slender species, described under *Tettix angustus*. A series of specimens from S. W. Blatchley, from Vigo County, Indiana, and a number from A. P. Morse, of Wellesley, Mass., furnished valuable assistance in making comparisons.

Gen. **TETTIX** Charp.

1. **T. granulatus** Kirby (Plate VI, fig. 3, 3a).

Cephalo-dorsal outline as shown plate ix, fig. 28. Easily recognized by the angulate character of the vertex.* A uniformity of structure is common in specimens taken in Chicago, Riverside, and at Dune Park, Ind. Colors are extremely variable.

Length of body ♀, 15 mm.; ♂, 12 mm.

Abbreviated variety, ♀; a single specimen from Chicago and one found at Dune Park, Ind., resembles this form, excepting an abortive condition of the wings and pronotum. Wings not passing the hind femora. The vertex, while angulate, hardly advanced as far in front of the eyes. Length of body 9 mm.

2. **T. ornatus** Say (Plate VI, fig. 1, 1a).

Cephalo-dorsal outline as shown plate ix, fig. 29. Between this and the form *triangularis* there is no tangible specific difference. The latter is an abbreviated variety (see plate vi, fig. 2, 2a), and much confusion has existed respecting it. In dry open woods in upland country it often takes on the color phase, *bilineata* of Harris, plate viii, fig. 20.

Chicago, Riverside and Rivergrove, Ill.

* The Western species is *T. incurvatus* Hancock. See "American Naturalist," August, 1895, p. 761.

3. ***T. angustus*** sp. n. (Plate VI, fig. 4, 4a).—Cephalo-dorsal outline as shown plate ix, fig. 24. Allied to *ornatus*; stature slender, eyes prominent, subglobose. Head swollen about the eyes, muffled, but slightly, by the pronotum; vertex broader than an eye. subexcised a trifle in front of eyes, front margin approximately rectangular with sides of crown, the latter depressed on forward half, middle of vertex slightly carinated, barely produced; frontal costa behind antennæ rounded, advanced normally nearly as far as vertex, excavate sparingly opposite eyes; ocelli usually visible in profile at margin of deepest point; pronotum anteriorly truncate, slender, subtectiform; dorsum in front above articulation of first leg but slightly constricted, median carina slight, anterior marginal carina subparallel, short, separated hardly wider than vertex; lobes small, lower margin strongly oblique, inferior angle in profile subconvex below, sides of pronotum gently converging as far as knee of hind femora, apical process thin, extended far backwards, nearly same thickness throughout, terminating rather acutely, not reaching the end of wings. Legs thin under margin of first, and both margins of second femur indistinctly scalloped; dorsum of pronotum nearly horizontal, surface granulated, but not as smoothly as in *ornatus* or *granulatus*. Elytra oblong, surface punctate: face smooth; carinæ of the entire body reduced generally. Length of body ♀, 14 mm.; ♂, 12 mm.; pronotum ♀, 12 mm.; ♂, 10.5 mm.; hind femora ♀, 5.5 mm.; ♂, 5 mm.

Bloomington, Ill. (M. J. Elrod), Riverside, Ill.

Abbreviated variety. ♀.—Apical process of pronotum slightly passing hind knee, not quite reaching end of wings; lobes of pronotum short, inferior angle strongly projecting laterally, obtusely pointed, sinus immediately above deep. Length of body 10 mm.

Bloomington, Ill. (M. J. Elrod).

4. ***T. inflatus*** sp. n. (Plate VII, fig. 8).—Cephalo-dorsal outline as shown plate ix, fig. 26. Similar to *T. angustus*; stature more robust, eyes less globose and smaller. Head oblique, strongly muffled by the front antero-lateral margin of the pronotum; vertex a little wider in front, perceptibly broader behind, not excised as abruptly, projecting more in front of the eyes, carina of vertex hardly distinguishable, barely showing in front; in profile the frontal costa is more deeply and sharply excavate opposite the eyes almost to their front outline; pronotum broader, compact in front, anterior carina oblique, distance apart at the anterior dorsal margin considerably more than the front margin of vertex; dorsal surface between angles of lateral margin slightly swollen, immediately behind subdepressed, sloping gently backwards to process; median carina thin, almost obscure, apical process larger, concaved, not reaching end of wings; lobes larger, more turned out at the inferior margin; lateral carinæ in their front course sharply accentuated. Legs strong, anterior femora compressed, slightly carinated below, second femur subspatulate, distinctly carinated, both margins roughly scalloped; surface of dorsum tuberculate and granulated. Elytra elongate, punctate, sometimes slightly granulate. Length of body ♀, 12.5 mm.; ♂, 11 mm.; pronotum ♀, 12 mm.; ♂, 10 mm.; hind femora ♀, 6 mm.; ♂, 5 mm.

Riverside, Ill.

5. **T. obscurus** sp. n. (Plate VII, figs. 9, 9a and 10, 10a).—Cephalo-dorsal outline as shown plate ix, figs. 23 and 25. Differs from the foregoing, *T. inflatus*, which it most resembles, in having stature more slender, but broader than *T. angustus*. The vertex is about as wide, but the pronotum is flattened on the dorsum, and the lower margins of the lobes strongly distended laterally; surface of dorsum finely rugose. Wings overreach apical process.

5a. Plate VII, fig. 10, 10a.—Not quite as broad through the shoulders, about the same length, having the pronotum nearly horizontal and becoming concave posteriorly; median carina hardly raised between the shoulders, very thin, almost disappearing in its backward course to the apex; pronotum not strongly constricted, corrugations but slightly shown; dorsum not flattened quite as much; a short wing form also occurs. As stated above it is not named, pending further study. Length ♀ 10 mm.

Riverside, Ill.

6. **T. gibbosus** sp. n. (Plate VI, fig. 5, 5a).—Cephalo-dorsal outline as in fig. 30, plate ix. Vertex in profile produced, angulate, frontal costa excavate but little in front of the eyes, the carinated front border of face below bent forward, rather flattened at the middle, face slightly oblique, eyes prominent; from above the small mid-carina of vertex projects plainly from the middle of the excised front border; pronotum truncated in front, flattened on dorsum, the latter is broad, with a pronounced anterior dorsal hump between the shoulders, raised above level of eye; behind the hump the dorsum is sharply depressed, behind this again a much smaller protuberance, rarely a broken surface follows in profile, median carina slightly more distinct than the lateral ones; dorsum not uncommonly with transverse roughened lines: apical process not greatly lengthened, sometimes reaching beyond the wings, but oftener not passing the latter; lateral angles of dorsum strongly projecting over the tegmina; tegmina with surface punctate and granulate. Length of body ♀, 11.5 mm.; pronotum ♀, 10.5 mm.

By contrast with *granulatus* the vertex is strongly pointed, and the frontal costa is sharply excavate. The general color of specimens is often like the ground upon which they find subsistence. Special markings occurring in this species is shown in plate viii, figs. 14–20. In recent specimens a tinge of opaque green is often found with dark mottlings on the sides of the abdomen. It frequents the more shaded portion of the banks of the Des Plaines River, and is found from early Spring to late Fall. Flight is not often attempted, rather preferring to hug the ground closely.

Abbreviated variety.—A slightly smaller form exists with characters nearly the same, excepting the pronotum and wings; met with in the same situations. The pronotum is not extended into such a slender point behind, the sides are more nearly straight, very frequently individuals are found with the tip of the apical process slightly decurved or distorted, and just reaching the end of the wings and posterior knee. The shortness of the body in this variety

often gives greater prominence to the dorsal hump in front as well as making the lateral angles appear stronger, giving specimens a very unique appearance.

Riverside and Rivergrove, Ill.

7. ***T. fluctuosus*** sp. n. (Plate VII, fig. 6, 6a).—Cephalo-dorsal outline as in fig. 27, plate ix. Allied to *T. gibbosus*; vertex in profile produced into a small pyriform prominence in advance of the upper part of the eyes; frontal costa deeply notched opposite the eyes; the vertex above is about equal to the combined width of the eyes, flattened and shallowly sunken in front each side of the scarcely distinguishable mid-carina, the latter just appearing at the cut-off front border; pronotum truncated in front, flattened on dorsum, rather broad with an anterior dorsal elevation between the shoulders, depressed behind, lateral angles strong, sharply carinated and projecting laterally over the base of the tegmina, lateral borders of process compressed, apical process tapering and concavely curving to the end, not reaching the end of the wings. In front the pronotum is constricted, corrugated and deeply depressed each side of the dorsal hump, formed into an angular pit pointing inward in the humeral portions; median carina not distinct, its course behind the dorsal elevation from before backwards broken by a succession of very small gradually decreasing protuberances frequently granulated upon their summits; lower border of lateral lobes diverging and rounded posteriorly below. Body covered with granulations frequently light in color interspersed with tubercles on the dorsum. Elytra oblong, granulated and punctate; angles everywhere accentuated in this form. Length of body ♀. 13 mm.; pronotum ♀, 11.5 mm.

Riverside and Rivergrove, Ill.

Here, as in most of the other forms enumerated, a short-wing form is encountered and assigned a place in plate vii, fig. 6b, and the cephalo-dorsal outline is figured in figure 27a, plate ix; vertex similar to *T. fluctuosus*. The pronotum varies extremely. A specimen which forms the basis of these remarks has the dorsal elevation gracefully molded, raised as usual, but with five granulated protuberances marking the course of the median carina of nearly equal size. The wings do not extend as far as the end of the pronotum, the latter is almost straight on the sides terminating by an acute point decurved, distorted and not reaching the posterior knee.

8. ***T. decoratus*** sp. n. (Plate VII, fig. 7, 7a).—Cephalo-dorsal outline as in fig. 31, plate ix. Nearly allied to *T. gibbosus* and *fluctuosus*; small in stature; vertex produced much like *fluctuosus*, mid-carina indistinct, scarcely to be seen at the cut-off front border; the face is proportionally large; dorsum flattened, with an anterior hump. Wings extending a little beyond the end of the pronotum; easily mistaken for *T. ornatus*, which it resembles nearly in size, but distinctly different structurally. Length of body ♀, 11 mm.

Chicago, Riverside and Rivergrove, Ill.

Abbreviated variety.—Differing only in the abortive condition of pronotum and wings, which do not pass the hind knee; ♀, 10 mm.

Gen. **PARATETTIX** Bol.

1. **P. cucullatus** Burm. (Plate VII, fig. 11, 11a).

The commonest local form preferring the immediate border of streams. Chicago, Riverside and Rivergrove, Ill.

Experiment in hatching young of *Paratettix cucullatus*: Aug. 4, 1895, five or six specimens from Riverside were placed in a quart fruit jar with a little of the soil taken from the margin of the river. Contentment reigned for a few days, and in the interval they were constantly seen on the soil; copulation took place several times, then they commenced to die off one at a time, as is usually the case with this very wild species, owing to an inability to adapt themselves to close confinement. On the night of the 20th, or early morning of the 21st, dozens of newly-hatched young appeared on the bottom of the jar; a few were pale yellowish white, the rest have already taken on the warm gray color of the soil; fifty-six individuals were counted. After introducing the adult parent specimens they were not seen depositing their eggs, but conclude this was done soon after entering the jar, and sixteen days is the just estimate of the time required for the full term of incubation. August 21st, at 12.40 P.M., while looking in the jar a pale yellowish white, young, 1.5 mm. fell on the bottom; a moment later, from a crack in the side of the soil, another specimen emerged. The eyes at this early stage is reddish brown, the only visible color. Rather unsteadily it clung to the side of the earth while casting off the amnion, which, like a thin pellicle, enveloped the body. The shedding took place from the head backwards, finally adhering to the end of the abdomen for a few moments before the whole was completely discarded. Three minutes from this time the young specimen made a vigorous jump across the jar. At 5.25 P.M. the soil was searched, being carefully separated, and two masses of eggs were discovered in different situations in the soil about an inch apart. When the eggs were laid the ground was wet and soft, a little pocket was made in one case, a crack being chosen for the other in which to deposit the eggs about one-quarter inch below the surface. Two young hatched when the writer was engaged in examining the last remaining unhatched eggs with a hand magnifying-glass; an opportunity was thus given to

observe a few more details to the process. Eggs when first laid are a creamy white, becoming brownish with age; it is 1.5 mm. in length, cylindrical, curved a little and rounded at the ends. The anterior end is laid pointing upwards; in those at the top the extremity is provided with a little sharp point. When the young is about to make its exit a rent occurs down the middle from before backwards. In one case the insect simply raised up and backed out to extricate itself, then shedding the amnion as briefly described above. If there is ample room for the eggs as there was here, the pressure exerted within by the embryo bursts the shell at the point of least resistance along the back beginning at the anterior end, but not always with definite precision. Most of the eggs examined seemed completely divided longitudinally through the middle, while others showed that emergence had taken place from forward end, passing between the neighboring eggs up the shallow burrow. The separate masses or pods contained approximately thirty eggs each. The young take on pigment a few hours after hatching and very closely resemble each other. The progeny at this time is perfectly equipped to launch into the world about.

Young of *Paratettix* just hatched from the egg.—Pale yellowish white, length 1.5 mm. In profile head large, rather swollen, front margin convexed, summit rounded, angulate; eyes deep reddish brown situated high, the crown showing slightly in outline above; antennæ short, enlarged toward the end with ten articles; pronotum in the form of small shield about as long as the height of the head, lightly encroached on the head, cut-off in front, slightly constricted directly over the attachment of first leg showing as a slight indentation near the anterior dorsal margin; lobes rounded off below in front, deeply grooved behind, forming a sinus just above and in front of second leg; pronotum sliced and sloped thin at the sides abruptly into small posterior process slightly tilted up at the apex. The apical end passes back a third of the length of the posterior femur; median and very small lateral carina present; borders of posterior femur convexed. Abdomen extending almost to the posterior knee.

Gen. **TETTIGIDEA** Scudd.

1. **T. acuta** Morse (Plate VII, fig. 13, 13a).

Chicago and Riverside, Ill.

2. **T. parvipennis** Harris (Plate VII, fig. 12, 12a).

Until recently this species was designated *T. lateralis*. Morse

(Journ. N. Y. Ent. Soc. March, 1895), after examining specimens from the Southern States, concludes that Say's species is restricted. Harris applied *parvipennis* to the short-wing variety. Abbreviated varieties of this and the foregoing species are found at Riverside. Members of the genus *Nomotettix* Morse, have not personally been taken up to the present writing.

EXPLANATION OF PLATES.

PLATE VI.

Fig. 1. *Tettix ornatus*. Very much enlarged.

- " 1a. " " Head and pronotum drawn to smaller scale.
- " 2. " *triangularis* var.
- " 2a. " " pronotum and head.
- " 3. " *granulatus*.
- " 3a. " " pronotum and head.
- " 4. " *angustus* sp. n.
- " 4a. " " " pronotum and head.
- " 5. " *gibbosus* sp. n.
- " 5a. " " " pronotum and head.

♀ sex used throughout in these and following figures. Enlarged, original from nature.

PLATE VII.

Fig. 6. *Tettix fluctuosus* sp. n.

- " 6a. " " " pronotum and head.
- " 6b. " " var. n.
- " 7. " *decoratus* sp. n.
- " 7a. " " " pronotum and head.
- " 8. " *inflatus* sp. n.
- " 9. " *obscurus* sp. n.
- " 9a. " " " pronotum and head.
- " 10. " " var. n.
- " 10a. " " " pronotum and head.
- " 11. *Paratettix cullatus* Burm.
- " 11a. " " " pronotum and head.
- " 12. *Tettigidea parvipennis* Harris.
- " 12a. " " " from above.
- " 13. " *acuta* Morse.
- " 13a. " " " pronotum and head.

Enlarged, original from nature.

PLATE VIII.

Markings on the disc of pronotum of *Tettix* showing evolution of the pigmented areas. From specimens in the author's collection.

Fig. 14. Unmarked, or primitive type.

" 15. Early type of pigmentation.

" 16, 17, 18, 19. Advancing stages of pigmentation.

" 17. In this type simultaneous pigment marking in front with the spots further back.

" 20. Harris' type "*Tetrix bilineata*," a variable form of marking of *Tettix ornatus*.

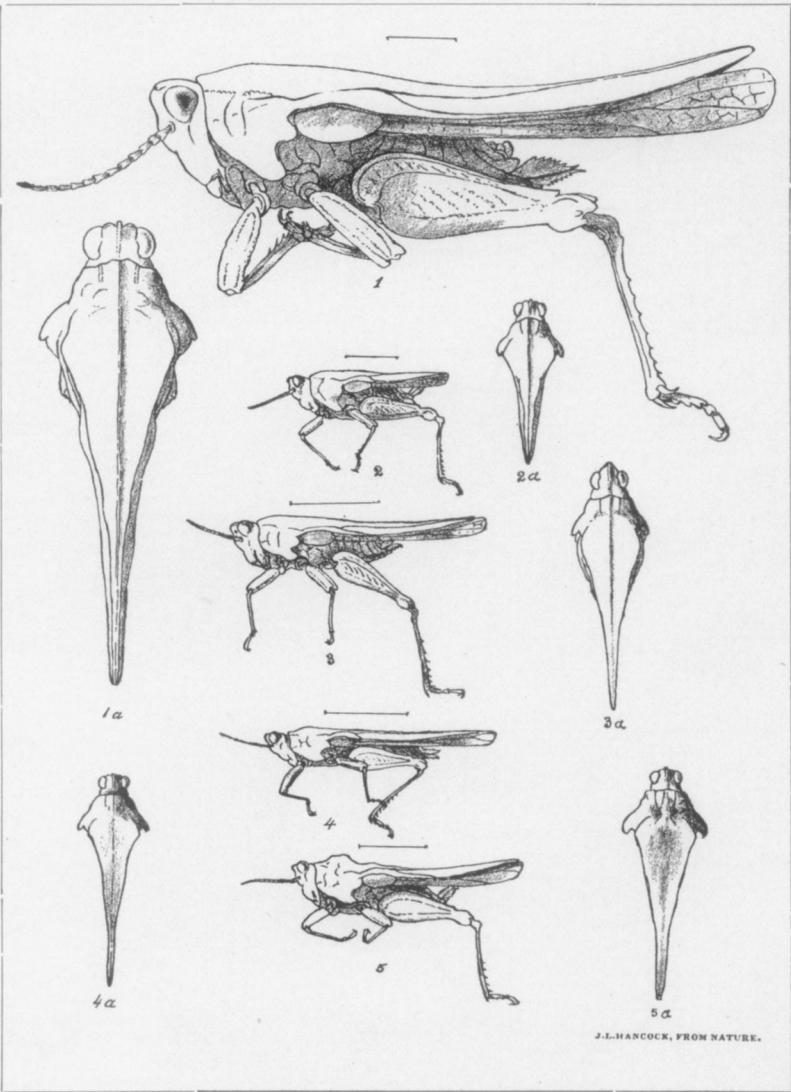
" 21. Young of *Tettix*, a few days old, showing marking at *a*.

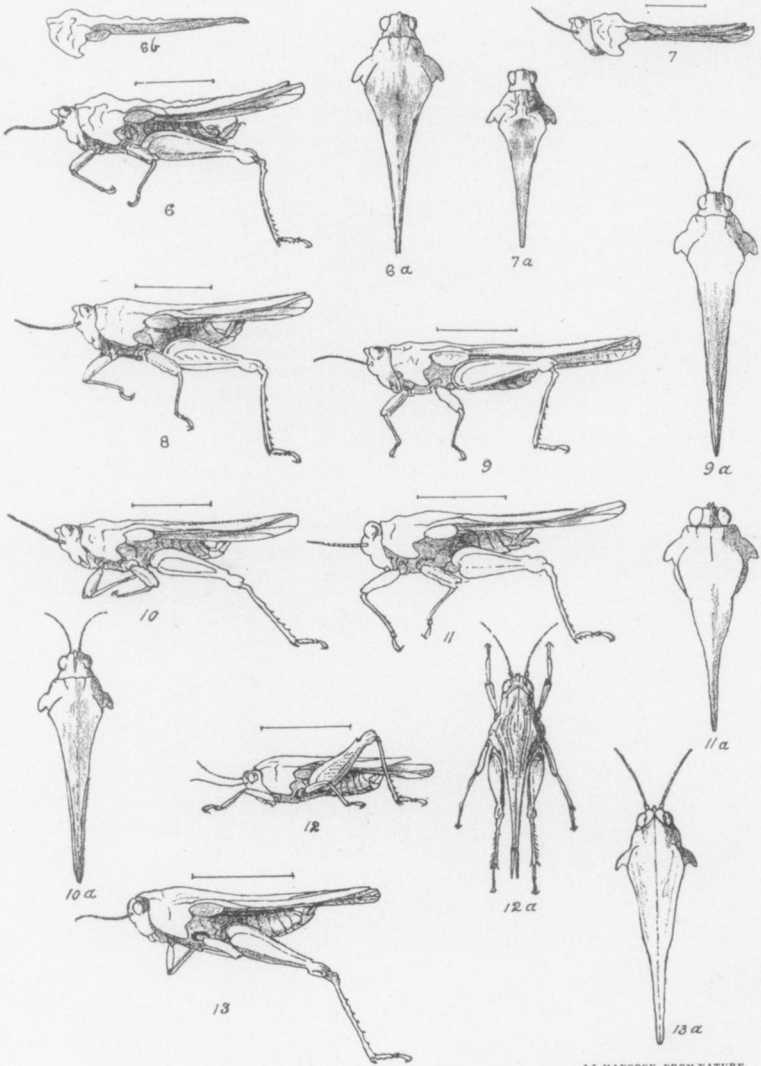
Figures drawn to uniform scale. 14-19 inclusive, from specimens of *Tettix gibbosus*. Enlarged, original from nature.

PLATE IX.

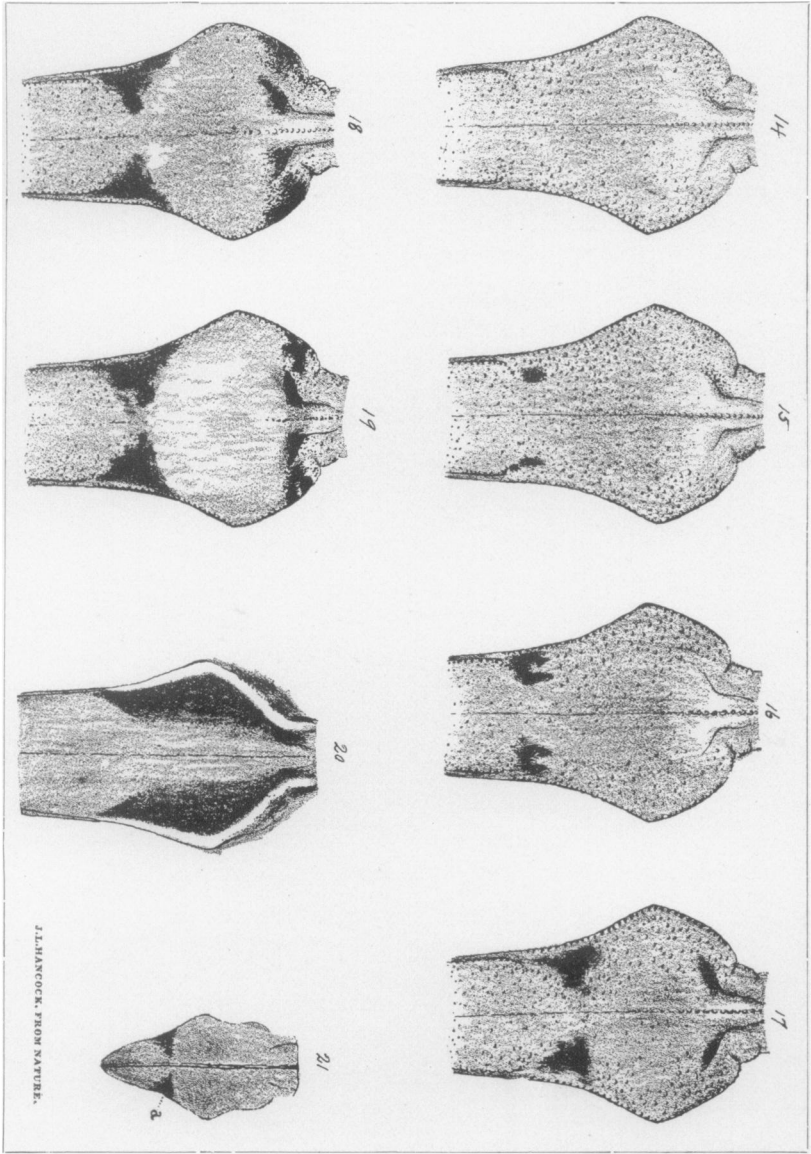
Figs. 23-31a. Cephalo-dorsal outline of different forms of *Tettix* for comparison.

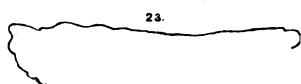
The figures are self-explanatory, original, from nature, enlarged.



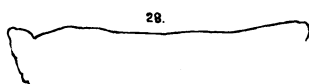


J. L. HANCOCK, FROM NATURE.

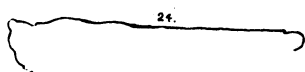




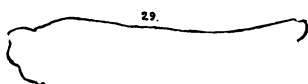
obscurus var. n.



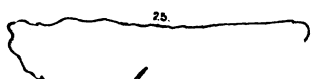
granulatus



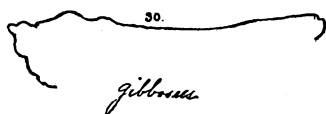
angustus



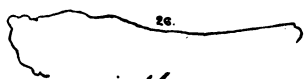
ornatus



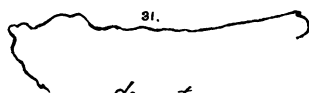
obscurus



gibbosus



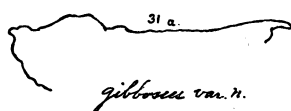
inflatus



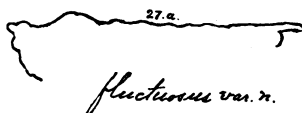
decoratus



fluctuosus



gibbosus var. n.



fluctuosus var. n.

J. L. HANCOCK, FROM NATURE.